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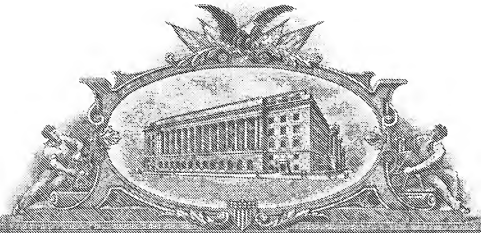

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March 03, 2005

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APPLICATION NUMBER: ***60/640,844***
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Certified by

Jon W. Dudas

Under Secretary of Commerce
for Intellectual Property
and Director of the United States
Patent and Trademark Office

PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

Express Mail Label No. EV334578096US

INVENTOR(S)		
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Additional inventors are being named on the 1 *separately numbered sheets attached hereto*

TITLE OF THE INVENTION (500 characters max):

METHOD AND SYSTEM FOR PROVIDING GEOGRAPHIC REDUNDANCY

Direct all correspondence to: **CORRESPONDENCE ADDRESS**

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ENCLOSED APPLICATION PARTS *(check all that apply)*

☑ Application Data Sheet. See 37 CFR 1.76 ☐ CD(s), Number of CDs ———

☑ Specification *Number of Pages* 17 ☑ Other (specify) Express Mail Certificate

☐ Drawing(s) *Number of Sheets* ———

Application Size Fee: If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

METHOD OF PAYMENT OF FILING FEES AND APPLICATION SIZE FEE FOR THIS PROVISIONAL APPLICATION FOR PATENT

☑ Applicant claims small entity status. See 37 CFR 1.27. TOTAL FEE AMOUNT ($)

☑ A check or money order is enclosed to cover the filing fee and application size fee (if applicable). 100

☐ Payment by credit card. Form PTO-2038 is attached

☐ The Director is hereby authorized to charge the filing fee and application size fee (if applicable) or credit any overpayment to Deposit Account Number: ———. A duplicative copy of this form is enclosed for fee processing.

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☑ No.

☐ Yes, the name of the U.S. Government agency and the Government contract number are: ———

SIGNATURE [signature] Date December 30, 2004

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TELEPHONE 972 739-8638 Docket Number: 29981.116

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PROVISIONAL APPLICATION COVER SHEET
Additional Page

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Xu et al.	§	Attorney Docket No. 29981.116
	§	Customer No. 27683
Serial No. Unknown	§	Group Art Unit: To be Determined
Filed: Herewith	§	Examiner: To be Determined
For: Method and System for Providing Geographic Redundancy	§	

EXPRESS MAIL CERTIFICATE

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I hereby certify that the following attached papers and fee:

1. Provisional Application for Patent Cover Sheet (in duplicate);
2. Provisional Patent Application consisting of 17 pages of specification,
3. Drawing sheets incorporated into specification;
4. Application Data Sheet;
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are being deposited with United States Postal Service "Express Mail Post Office to Addressee" via **Express Mail Number: EV334578096US** to the Commissioner for Patents, Box Provisional Patent Application, Alexandria, VA 22313-1450, on the **30th day of December, 2004.**

Gayle Conner

PROVISIONAL PATENT APPLICATION

METHOD AND SYSTEM FOR PROVIDING GEOGRAPHIC REDUNDANCY

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Attorney Docket No. 29981.116
R-94995

METHOD AND SYSTEM FOR PROVIDING GEOGRAPHIC REDUNDANCY

WRITTEN DESCRIPTION

The present disclosure relates generally to voice and data communications and, more particularly, to method and system for providing geographic redundancy in a communications network.

It is to be understood that the following disclosure provides many different embodiments, or examples, for implementing different features of the disclosure. Specific examples of components and arrangements are described below to simplify the present disclosure. These are, of course, merely examples and are not intended to be limiting. In addition, the present disclosure may repeat reference numerals and/or letters in the various examples. This repetition is for the purpose of simplicity and clarity and does not in itself dictate a relationship between the various embodiments and/or configurations discussed.

TABLE OF CONTENTS

1 INTRODUCTION

This application describes a Geographic Redundancy feature for use in telecommunications systems, such as the Atrium product produced by Spatial Communication Technologies, Inc.

1.1 SCOPE

The document specifies exemplary WSS, MGW, and EMS requirements to support Geography Redundancy in the Spatial Atrium System within the PLMN network.

1.2 DEFINITIONS AND ACRONYMS

CCM	Call Control Module
CDR	Call Detail Record
EMS	Element Management System
GMSC	Gateway Mobile Switching Center
IP	Internet Protocol
MGW	Media Gateway
SAM	System Admin Module
SIM	Signaling Interface Module
VLR	Visitor Location Register
VMSC	Visiting Mobile Switching Center
WSS	Wireless Soft-Switch

Active WSS
The WSS that is visible from the network. The Active WSS controls one or more MGW and performs call control signaling for voice and data call. The Active WSS can function as a VMSC, GMSC or combined GMSC/VMSC.

Standby WSS
The Standby WSS has the same hardware configuration as the Active WSS. It is fully operational as a WSS, but it is not visible from the network and does not communicate to any MGW.

WSS-A
This is the Active WSS in the initial deployment.

WSS-B
This is the Standby WSS in the initial deployment.

2 FEATURE GENERAL DESCRIPTION

Spatial Atrium Geographic Redundancy System consists of an Active WSS, a Standby WSS, and one or more MGWs. A network of two redundancy systems is shown below:

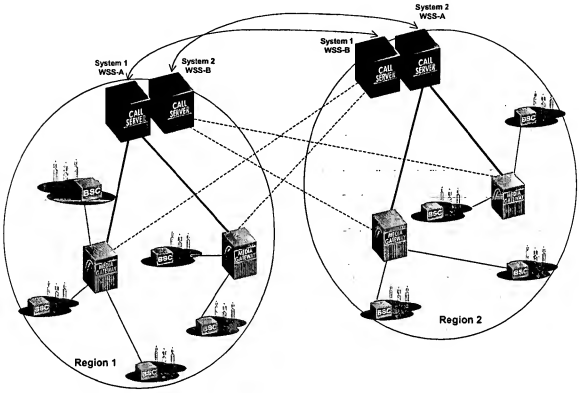


Figure 1 - Network Diagram

Geographic Redundancy feature provides the ability to completely backup a WSS in a different geographic location. In the diagram above, System 1 has an Active WSS-A in region 1 and a Standby WSS-B in region 2. System 2 has an Active WSS-A in region 2 and a Standby WSS-B in region 1.

In the initial deployment, WSS-A is the Active WSS. It controls all connected MGWs and handles all incoming and outgoing traffic for this destination. WSS-B is the Standby WSS. It is fully operational but it does not communicate with any MGW. WSS-B does not receive any call request from the network because all its SS7 links are locked. WSS-B is not visible from the external network.

In the event of a complete failure of the Active WSS, such as in the case of a disaster, the Standby WSS will raise an alarm indicating the Active WSS is not operational. A special command will be available from EMS to activate the

Standby WSS, which will takeover the control of all MGWs and unlock all SS7 links in order to resume services to the affected area. The WSS-B is a complete replacement of WSS-A.

From the network perspective, WSS switchover has the same effect as if the WSS goes out-of-service momentarily and comes back in-service again. That is, the WSS goes out-of-service when the WSS-A failed and the WSS comes back in-service after the WSS-B is activated.

3 FUNCTIONAL DESCRIPTION

The main components of a Geographic Redundancy System are shown below. Figure 2 shows the connections when WSS-A is Active. The Active WSS has a pair of IP addresses to control each MGW and each MGW has a pair of IP addresses for sending SNMP Traps to the Active WSS.

Each WSS has its own SS7 Point Code as well as a common Alias Point Code. The STP uses the Alias Point Code to route the traffic to the Active WSS.

Signaling channels from the BSC are extracted from the BSS trunks and cross-connected in the MGW to one or more T1 signaling links connected to the SIMs in WSS-A.

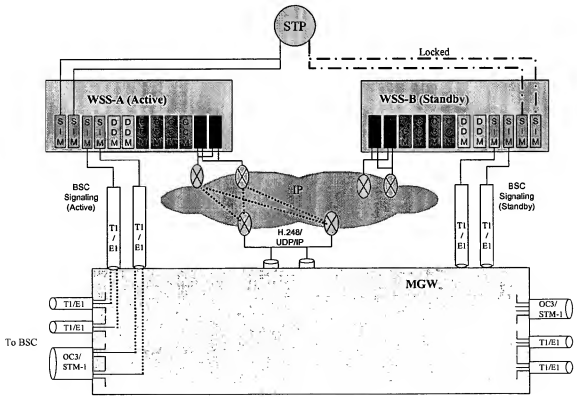


Figure 2 - Geographic Redundancy (WSS-A=Active)

WSS-A and WSS-B must have the same hardware configuration. WSS-A and all MGWs are configured using the normal provisioning procedures on the EMS connected to WSS-A. Configuration of WSS-B is performed through a synchronization process, where provisioning data is copied from WSS-A to WSS-B.

All data required to configure Geographic Redundancy operations are specified in the Geo-layer on the EMS Configuration Screen. The Geo-layer is a new layer between the "Spatial Atrium" and the "Nodes" level.

Figure 3 below shows the Geographic Redundancy System when WSS-B is Active (i.e. after WSS switchover).

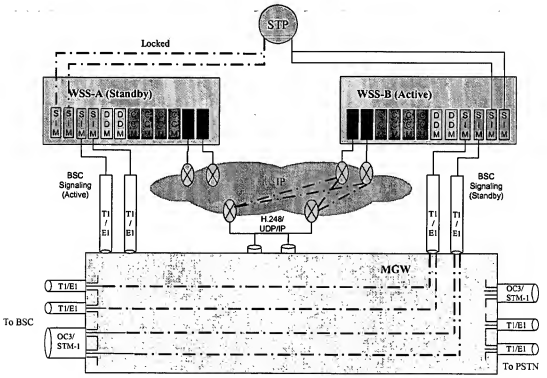


Figure 3 - Geographic Redundancy (WSS-B=Active)

The MGW has the same IP address regardless whether WSS-A or WSS-B is active. The Active WSS-B will use this IP address to control the MGW after the switchover. The Active WSS-B will also instruct the MGW to use the new IP addresses for sending SNMP Traps to WSS-B.

The cross-connection in the MGW will be reconfigured at switchover so that Signaling channels from the BSC are cross-connected one or more T1 signaling links connected to the SIMs in WSS-B.

The STP always sends all traffic to the Active WSS. No traffic will be routed to the Standby WSS because all SS7 links are locked.

3.1 NORMAL OPERATION

In addition to the traffic handling function provided by a normal WSS, the Active WSS in the Geographic Redundancy System shall also provide the following functionality:

- The Active WSS shall continuously monitor the Standby WSS to ensure it is "alive". An alarm shall be raised if no response if received from the Standby WSS after a predefined time.

The Standby WSS in the Geographic Redundancy System is fully operational with the exceptions of the following:

- The Standby WSS shall not send any message to the MGW, nor response to any message from the MGW.
- Attempts to unlock any SS7 link from EMS shall be rejected.
- The Standby WSS shall continuously monitor the Active WSS to ensure that it is "alive". An alarm shall be raised if no response is received from the Active WSS after a predefined time.

The maximum capacity (BHCA) of the system shall not be affected when Geographic Redundancy is in use.

3.2 WSS SWITCHOVER PROCESS

In order to support manual switchover as a maintenance procedure, WSS switchover shall be performed in two steps:

- Lock Active WSS
- Unlock Standby WSS

The description below specifies actions required for switchover from WSS-A to WSS-B. It shall also be possible to switchover from WSS-B back to WSS-A

1) Lock Active WSS:
   The actions below shall be performed by WSS-A if it is Active. These actions are not required if WSS-A is no longer operational.
   - Lock all SS7 links in WSS-A
   - Stop all communications between WSS-A to the MGW
   - Inform WSS-B that WSS-A is no longer operational
   - All existing calls in the setup stage will be dropped. All existing stable calls will be maintained by the MGW.

2) Unlock Standby WSS:
The following actions shall be performed by WSS-B:
- Verified that the WSS-A is not operational.
- WSS-B takes over the control of the MGW.
- WSS-B redefines the msc-node table in each MGW by sending its node number, administration state and IP address of every node in WSS-B to the MGW.
- WSS-B reconfigures the BSC signaling channel cross-connection.
- WSS-B unlocks SS7 links. The destination becomes available.
- All new call will be routed to WSS-B.
- Any message received by the WSS-B without a valid call ID will be dropped. MGW resources allocated prior to WSS switchover will be cleaned up by the periodic Resource Audit function
- If there is more than one MGW, steps above shall be repeated for each MGW.

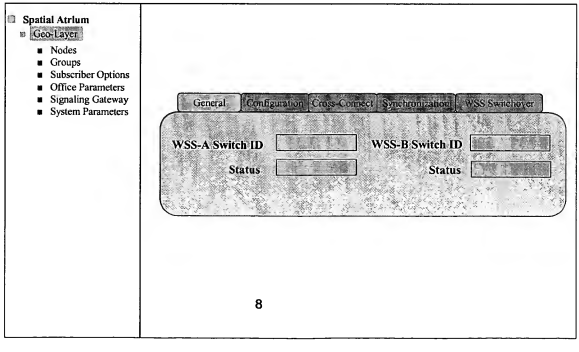
The time required to "unlock Standby WSS" shall be less than two minutes.

3.3 PROVISIONING OF GEOGRAPHIC REDUNDANCY FEATURE

There is no change to the provisioning of the WSS-A. The WSS is provisioned through EMS on the Wireless Soft Switch Node level.

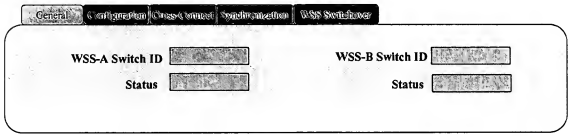
There is no change to the provisioning of the MGW. All MGWs are provisioned through EMS on the Wireless Media Gateway Node level.

It shall be possible to introduce Geographic Redundancy feature by adding a Standby WSS to the existing WSS/MGW system. All configuration data for Geographic Redundancy shall be specified in the Geo-layer with an EMS client connected to the Active WSS.



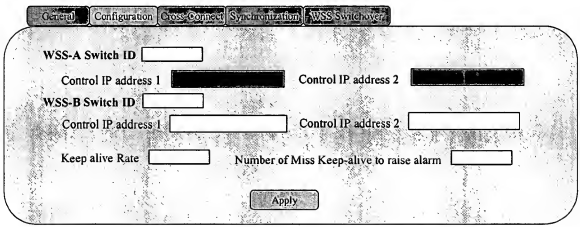
Note that once the Geographic Redundancy configuration data is synchronized to the Standby WSS, the Geographic Redundancy configuration data can also be viewed from the EMS connected to the Standby WSS, but modification of certain data, such as unlocking the SS7 link, shall not be allowed from the Standby EMS.

1) General Information



This panel displays the WSS-A Switch Identity, WSS-B Switch Identity and the current status of each WSS. The Switch Identity shall be a string up to 31 characters

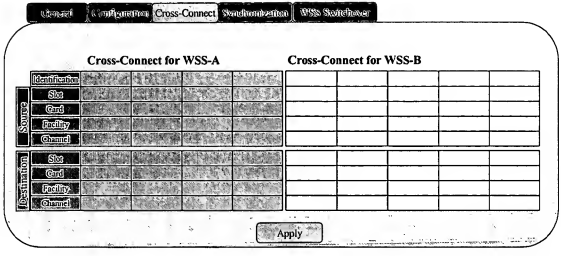
2) Configuration



The WSS-A Switch ID and WSS-B Switch ID are specified here. The IP addresses of WSS-B are specified in this panel. IP addresses for WSS-A have already been defined at the provisioning of WSS-A node and shall be retrieved from the database and display on the screen.

The Control IP address is used for all communications between the Active and Standby WSS, including keep-alive messages and synchronization. The keep-alive rate and alarm trigger due to missing keep-alive messages are also specified in this panel.

3) Cross Connection

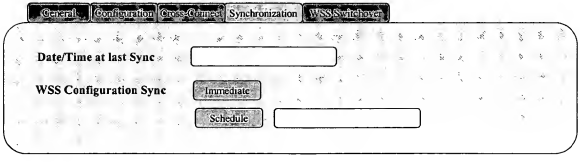


The Signaling channels from the BSC are extracted from the BSS trunks and cross-connected in the MGW to one or more T1 signaling links to be connected to SIM of the Active WSS. If these signaling links from the MGW is connected to the WSS-A via STP or through an IP network (e.g. Sigtran), then when WSS-B takes over the MGW, these signaling links will be routed to WSS-B's SIM automatically.

However, if these signaling links are physically connected between the MGW and the SIM in WSS-A, then when the WSS-B take over the MGW, WSS-B must reconfigure the cross-connection in the MGW in order for the BSC signaling channels to be connected to the SIM in WSS-B.

Only cross-connection data for WSS-B needs to be specified here. Cross-connection data for WSS-A has already been defined at the provisioning of WSS-A node. This data shall be retrieved from the database and display on the screen.

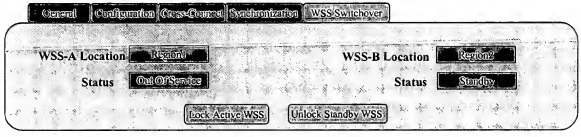
4) Synchronize Standby WSS



Once the Geographic Redundancy configuration data is specified, WSS-B can be automatically configured with the configuration_Sync function on the EMS. Immediate Configuration_Sync will update all configuration data in WSS-B to the mirror image of WSS-A. Configuration_Sync shall also add or update WSS-B control nodes (SAMs) to the MGW with the specified IP addresses. The state of the WSS-B shall be Standby after successful provision and all SS7 links shall be locked. It shall also be possible to schedule the synchronization process during the maintenance window.

Note that VLR data is not synchronized to the Standby WSS. After a WSS switchover, subscriber data is inserted into the VLR on a call by call basis.

5) WSS Switchover



When the Active WSS is no longer operational, the status of the WSS will be out-of- service. WSS switchover is performed by "Unlock Standby WSS" manually. For switchover when the Active WSS is still in operation, the Active WSS must be locked first before unlocking the Standby WSS.

3.4 MGW INITIALIZATION

Each MGW has an IP switch for internal communication. This IP switch shall be configured to handle Bootp relay.

When the MGW is power on, it broadcasts a Bootp message to everyone within its subnet. When the IP switch receives the broadcast Bootp message, it converts the message into four Unicast Bootp messages and send to the network. Each message has one of the following addresses as its destination IP address.

- WSS-A Active SAM IP address
- WSS-A Standby SAM IP address
- WSS-B Active SAM IP address
- WSS-B Standby SAM IP address

Only the Active SAM in the Active WSS will response to the Bootp message. This SAM will download all required data in order to start up the MGW.

3.5 FAULTS AND ALARMS HANDLING

There is no change to faults and alarms handling in the Active WSS. These will be handled in the same way as for normal WSS.

There is no change to faults and alarms handling within the MGW node. MGW alarms are sent to the Active WSS and they are handled in the same way as for normal WSS.

Faults and Alarms within the Standby WSS will be handled by the Standby WSS. Standby WSS will not receive any alarms from the MGW.

Both Active and Standby WSS are connected to the Operator Support System (OSS). All alarms generated by the Active WSS and the Standby WSS will be sent to the OSS. All MGW alarms will be forwarded to OSS by the Active WSS

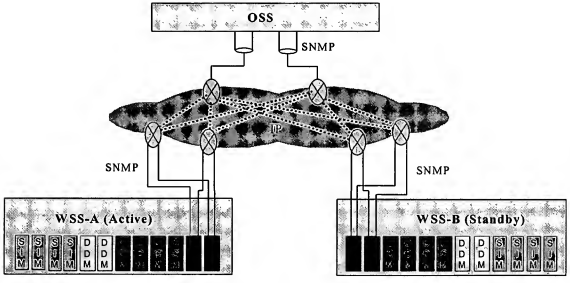


Figure 4 Interfaces to OSS

There are two specific alarms for Geographic Redundancy feature. These alarms will be integrated into the normal alarm handling.

Alarm from Active WSS:

ALARM_001
Event code: xxx
Severity: Major
Event name: Geo-Standby WSS Isolated

Event Information: Geo-Standby WSS Switch ID and control IP addresses
Event Type: Alarm on / Alarm off
Description: Geo-Standby WSS is not responding to keep alive.

Alarm from Standby WSS:

ALARM_002
Event code: xxx
Severity: Critical
Event name: Geo-Active WSS Isolated
Event Information: Geo-Active WSS Switch ID and its control IP addresses
Event Type: Alarm on / Alarm off
Description: Geo-Active WSS is not responding to keep alive. WSS switchover may be required.

3.6 BILLING AND PERFORMANCE

No special coordination is required between the Active and Standby WSS for billing and Performance data collection.

Both Active and Standby WSS are connected to the billing center. The Active WSS is continuously sending CDR to the billing center during normal operation. After a switchover occurs, any CDR not yet sent to the billing center will not be recovered automatically. All existing calls will be cleaned up when WSS-B becomes active. The Active WSS will be sending CDR to the billing center for all new calls.

Similarly, performance data is being sent to a central database. After a switchover occurs, any performance data not yet sent to the billing center will not be recovered automatically. The new Active WSS will be sending performance data to the central database from then on.

3.7 OPERATIONAL PROCEDURE

The following operational procedures shall be introduced:

- Configure Geographic Redundancy System
- Geographic Redundancy upgrade procedure

4 SYSTEM IMPACTS

4.1 SOFT-SWITCH

There will be two WSS in the Geographic Redundancy System. Only the Active WSS will be visible from the network at any time.

Below are system impacts on the WSS:

1) Standby WSS shall not send any message to the MGW.
2) Standby WSS shall not response to Bootp message
3) An IP connection shall be introduced between the Active and Standby WSS for monitoring and synchronization. Effective bandwidth required for this connection shall not exceed 1 Mbps for a 1M BHCA system configuration.

4.2 MEDIA GATEWAY

Two new SNMP commands shall be introduced to allow WSS-B to take over the control of the MGW at switchover:

- SNMP command SET STANDBY
  This command is used by the Active WSS to inform the MGW the control IP addresses of the Standby WSS.

- SNMP command SET MASTER
  This command is used by the Standby WSS to take over the control of the MGW at WSS switchover.

The MGW does not know which WSS is Active during MGW initialization. Therefore it shall send Bootp message to both WSS. In order to minimize impact to the MGW, it was decided to use the Cisco IP switch in the MGW to provide this functionality. The IP switch shall be configured to handle the conversion of broadcast Bootp message into four Unicast Bootp messages.

4.3 WIRELESS ELEMENT MANAGEMENT

On the EMS Configuration screen, a new item (called Geo-layer) shall be introduced to provide all necessary configuration of a Geographic Redundancy System. The Geo-layer shall be directly above the "Nodes" level

5 SYSTEM PERFORMANCE

5.1 RELIABILITY

The reliability within a single WSS is not affected. Reliability of the system is improved with the Standby WSS.

5.2 CAPACITY

No impact is foreseen due to the additional geographic redundancy functionality

6 FUTURE ENHANCEMENT

The following Geographic Redundancy functionality is not required in the first release. But it is proposed to consider for inclusion in the future releases.

1) Automatic switchover at complete failure of the Active WSS.
   In addition to manual switchover capability, it shall be possible to configure automatic switchover when a complete failure of the Active WSS is detected. This will reduce the WSS down time.

2) Synchronization of VLR data between the Active and Standby WSS.
   This improvement allows the VLR database in the Standby WSS to be updated periodically. The synchronization shall be performed during the maintenance window with a control mechanism to limit the transfer to the available bandwidth. For the first call each subscriber makes after a WSS switchover, the call setup time and the successful rate will be improved if the subscriber has the correct data in the VLR.

3) Possibility for different hardware configuration in the Standby WSS.
   This added functionally makes it possible for the Active and Standby WSS running different hardware releases or hardware configuration in the normal operation. Special mechanism shall be introduced to ensure all configuration data in the Active and Standby WSS are consistent.

4) Synchronization of billing data between the Active and Standby WSS.
   This enhancement allows the billing data to be copied to the Standby WSS in real time. As a result, the lost of bill data after a WSS switchover will be minimized. Synchronization of billing data in real time will require a higher bandwidth between the Active and Standby WSS.

5) Active calls survive after switchover.
   Active call refers to call that is still in the setup phase. This improvement provides the necessary functionality to maintain as many calls as possible after a WSS switchover. In order to continue to process existing call after a WSS switchover, call state information must be synchronized to the Standby WSS

in real time, which requires a very high bandwidth between the Active and Standby WSS.

WHAT IS CLAIMED IS:

1. A system and method for providing geographic redundancy for telecommunications systems as described herein.

Application Data Sheet

Application Information

Application Type::	Regular
Subject Matter::	Provisional
Title::	METHOD AND SYSTEM FOR PROVIDING GEOGRAPHIC REDUNDANCY
Attorney Docket Number::	29981.116
Request for Early Publication?::	No
Request for Non-Publication?::	No
Suggested Drawing Figure::	1
Small Entity::	Yes
Petition Included?::	No
Secrecy Order in Parent App.?::	No

Applicant Information

Applicant Authority Type::	Inventor
Primary Citizenship Country::	US
Status::	Full Capacity
Given Name::	Jianming
Family Name::	Xu
City of Residence::	Plano
State or Province of Residence::	TX
Country of Residence::	US
Street of Mailing Address::	4305 Vanderpool Drive
City of Mailing Address::	Plano
State or Province of Mailing Address::	TX
Country of Mailing Address::	US
Postal or Zip Code of Mailing Address::	75024

Applicant Authority Type::	Inventor
Primary Citizenship Country::	US

Status::	Full Capacity
Given Name::	Charles
Middle Name::	Marvin
Family Name::	Berteau
City of Residence::	Plano
State or Province of Residence::	TX
Country of Residence::	US
Street of Mailing Address::	8328 Barber Oak Drive
City of Mailing Address::	Plano
State or Province of Mailing Address::	TX
Country of Mailing Address::	US
Postal or Zip Code of Mailing Address::	75025

Applicant Authority Type::	Inventor
Primary Citizenship Country::	Canada
Status::	Full Capacity
Given Name::	Ghassan
Family Name::	Naim
City of Residence::	Garland
State or Province of Residence::	TX
Country of Residence::	US
Street of Mailing Address::	5413 Naaman Forest Blvd. #836
City of Mailing Address::	Garland
State or Province of Mailing Address::	TX
Country of Mailing Address::	US
Postal or Zip Code of Mailing Address::	75044

Applicant Authority Type::	Inventor
Primary Citizenship Country::	US
Status::	Full Capacity
Given Name::	Hoa

Middle Name::	Wah
Family Name::	Kong
City of Residence::	Plano
State or Province of Residence::	TX
Country of Residence::	US
Street of Mailing Address::	8104 Bent Tree Springs Dr.
City of Mailing Address::	Plano
State or Province of Mailing Address::	TX
Country of Mailing Address::	US
Postal or Zip Code of Mailing Address::	75025

Applicant Authority Type::	Inventor
Primary Citizenship Country::	US
Status::	Full Capacity
Given Name::	Shiang
Middle Name::	Yueng
Family Name::	Feng
City of Residence::	Colleyville
State or Province of Residence::	TX
Country of Residence::	US
Street of Mailing Address::	3402 Fox Meadows Drive
City of Mailing Address::	Colleyville
State or Province of Mailing Address::	TX
Country of Mailing Address::	US
Postal or Zip Code of Mailing Address::	76034

Applicant Authority Type::	Inventor
Primary Citizenship Country::	India
Status::	Full Capacity
Given Name::	Seshagiri
Middle Name::	Rap
Family Name::	Madhavapeddy

City of Residence::	Richardson
State or Province of Residence::	TX
Country of Residence::	US
Street of Mailing Address::	2521 Big Horn Lane
City of Mailing Address::	Richardson
State or Province of Mailing Address::	TX
Country of Mailing Address::	US
Postal or Zip Code of Mailing Address::	75080

Applicant Authority Type::	Inventor
Primary Citizenship Country::	US
Status::	Full Capacity
Given Name::	Pardeep
Family Name::	Kohli
City of Residence::	Plano
State or Province of Residence::	TX
Country of Residence::	US
Street of Mailing Address::	8621 High Meadows Drive
City of Mailing Address::	Plano
State or Province of Mailing Address::	TX
Country of Mailing Address::	US
Postal or Zip Code of Mailing Address::	75025

Correspondence Information

Correspondence Customer Number::	27683
Phone Number::	972 739-8638
Fax Number::	214.200.0853
E-Mail Address::	ipdocketing@haynesboone.com

Representative Information

Representative Customer Number::	27683

Assignee Information

Assignee Name::	Spatial Communication Technologies, Inc.
Street of Mailing Address::	1651 Glenville Drive, Suite 216
City of Mailing Address:	Richardson
State or Province of Mailing Address::	TX
Country of Mailing Address::	USA
Postal or Zip Code of Mailing Address::	75080